

Mr. E. F. Law (London) dealt with the non-metallic impurities in steel. His paper is the result of an examination of more than one hundred steels. The impurities have been considered as consisting of five in number, namely, iron sulphide, manganese sulphide, iron silicate, manganese silicate, and iron oxide. Iron sulphide very rarely occurs in commercial steels, and is therefore not considered at length. Manganese sulphide is always present in steel, and is usually harmless. The only instance in which it has been found to exert injurious influence on the quality of the steel is when it segregates with phosphide of iron in the form of "ghosts." Silicates of manganese and iron are frequently found in steel, and are highly injurious to the quality of the metal. In large forgings they sometimes occur in considerable masses, but in rolled steel they are distributed throughout the mass. In either case they are responsible for many failures. No indication of their presence is afforded by ordinary commercial means, and they can only be detected under the microscope. Oxide of iron frequently occurs in Bessemer steel. It occurs in a finely divided state, and there is evidence that it is soluble in steel. As a general rule, steels which on pickling evince a tendency to blistering are high in oxygen. The effect of hydrogen on steel containing oxide is discussed, and experiments were made with the view of determining the temperature at which the oxide is reduced. The results of these experiments tend to show that the oxide is reduced at 100° C. Iron oxide differs from other impurities present in its electrical behaviour, and the influence of this difference on the corrosion of iron and steel is discussed. It has been found that the presence of oxide accelerates corrosion, and corrosion of welded iron affords an illustration of this action. Other instances of the effects of the presence of oxide may be found in the pitting of boiler plates and tubes.

The last paper on the programme dealt with the nomenclature of iron and steel. This is the report of an influential committee of the International Association for Testing Materials which was presented by Prof. H. M. Howe (New York) and Prof. A. Sauveur (Harvard) at the Brussels congress of that association. It was then proposed that the report be submitted to the Iron and Steel Institute for consideration, and the secretary will be pleased to receive written comments for publication in the journal.

The meeting concluded with the usual votes of thanks to the Institution of Civil Engineers, proposed by the president and seconded by Sir John Alleyne, and to the president, proposed by Mr. G. Hawksley and seconded by Mr. Saladin (Le Creusot).

On Friday evening the annual banquet was held, with the president in the chair. Four hundred members were present, and the speakers were the Austrian Ambassador, the Swedish Minister, Sir James Kitson, Mr. Yves Guyot, Admiral Sir Cyprian Bridge, Sir C. E. Howard Vincent, Lord Justice Fletcher Moulton, and Mr. Robert Hammond.

CHIMÆROID FISHES.

A MEMOIR on "Chimæroid Fishes and their Development," by Prof. Bashford Smith, has been issued as Publication No. 32 of the Carnegie Institution of Washington. It begins with a short review of the researches in comparative anatomy and palæontology, which led to the view that chimæroid fishes are the most primitive vertebrates or the least modified descendants of the ancestral cranium- or jaw-bearing vertebrate; that, although shark-like, they are nevertheless widely distinct from the shark; and that altogether they represent a lower plane in piscine evolution.

Admitting the importance of the grounds on which these conclusions were based, Prof. Dean refers to the incomplete nature of the evidence. The material at the disposal of investigators was inadequate for the solution of the great morphological problems involved, and especially embryological material was extremely scanty or absent. The author himself failed for several years in his efforts to obtain satisfactory materials, until his attention was directed by President Jordan to the vicinity of the Hopkins

Marine Laboratory at Monterey as a promising locality for collecting *Chimaera coliei*. Under the guidance of a Chinese fisherman, Ah Tack Lee, who not only possessed a perfect knowledge of the *Chimaera* grounds, but proved to be a keen observer of the habits of the fish, the author obtained hundreds of specimens of the adult fish and of ova. Such of the latter as were not required for immediate examination were placed in a case, which was then sunk, attached to a buoy, in water of about five fathoms, to obtain the much needed series of developmental stages.

After having given an account of the habits and mode of propagation of the Californian *Chimaera*, the author enters into a full description of its egg and capsule in comparison with the ova of other *Chimaeroids*. This is followed by a detailed account of the various stages of development of the embryo and of the post-larval growth of the fish. Next the relationships of fossil *Holocephales* are considered. In the chapter on organogeny, the discussion of the obscure problem of the development of the dentition and of the homologies of its component parts in living and extinct forms will be studied with particular interest.

Anatomical, embryological, and palæontological evidence, then, appears to the author to be unmistakably in favour of *Chimaeroids* being widely modified rather than primitive forms. The recent forms retain less perfectly the general characters of the ancestral gnathostome than do living sharks. On the other hand, they have retained several characters of their Palæozoic Selachian ancestors which modern sharks have lost. The ancestral *Holocephali* diverged from the Selachian stem near or even within the group of the Palæozoic Cestracions, and the many features of kinship retained by the recent *Chimaeroids* and Cestracions distinctly point at this line of evolution.

The memoir is illustrated by 144 excellent text-figures and eleven plates.

BRITANNIC GEOLOGY.

FEW teachers have utilised the study of our own islands to greater advantage than Dr. Joseph H. Cowham, of the Westminster Training College. For thirty years past he has led his pupils over the varied country south of London, and the present writer is one of those who became pleasantly acquainted at an early date with his interest in scenery and his keenness for the details of a landscape. Dr. Cowham has published in "The School Journey" (Simpkin Marshall, pp. 80, price 1s.) an account of his methods, illustrated in the country between Croydon and Godstone; Mr. G. G. Lewis, a former pupil, describes an excursion in the Greenwich and Woolwich area; and Mr. T. Crashaw, another pupil, shows how a class may study erosion and deposition in river-courses on the banks of the Calder, in Lancashire. These expeditions appear to be wisely accepted as part of the regular school curriculum, instead of being relegated, as sometimes happens, to the holidays. Their effect in bringing together teacher and taught is rightly insisted on, and cannot be exaggerated; and the feeling is early engendered that the class-instruction in geography relates to something real and natural, which any eye can see and any willing brain can comprehend.

It is to such teachers, and to their pupils in later years, that the long-established Geologists' Association especially appeals. In part x. of its Proceedings (November, 1906, Stanford, price 1s. 6d.) Mr. R. S. Herries describes the geology of the Yorkshire coast between Redcar and Robin Hood's Bay, which was the scene of the long excursion of 1906. Especial interest here attaches to the estuarine representatives of the Middle Jurassic series, with *Equisetum columnare* "found upright in the sandstones as it originally grew," and to the zoning of the Lower Jurassic by the abundant ammonites. The valuable "Sketch of the Geology of the Birmingham District," by Prof. Lapworth, with a contribution on petrology by Prof. Watts and one on the glaciers by Mr. W. Jerôme Harrison, has now been reprinted from the Proceedings of the Geologists' Association for 1898 (Cornish Bros., Birmingham, pp. viii+104, price 2s. net), and will serve as a guide for generations of students in

the Midlands. The region includes exposures of the famous Permian boulder-beds (pp. 60-64), on which we should now like the opinion of some South African geologist.

The Geological Survey of the United Kingdom, which is intent on bringing the knowledge of our own islands up to date, issued two memoirs, with accompanying colour-printed maps, at the close of 1906. In one, Mr. W. A. E. Ussher describes the country between Wellington and Chard (Memoirs of the Geological Survey, "Explanation of Sheet 311," pp. vi+68, price 1s. 3d.). The map, Sheet 311 of the new series, centres in the interesting watershed of the Black Down Hills, where the streams running south and west have cut through a plateau of Cretaceous rocks into the underlying Trias. The westward extension of the Selbornian beds (largely of Albian age) beyond the Rhætic and Jurassic, and their striking unconformity with these earlier strata, form interesting features in the map. The "clay with flints" appears for the first time in this region as "in part Eocene." The difficulty of selecting colours for superficial deposits which will suit all areas of our complex island is seen in the resemblance between "valley gravel and rainwash" and Triassic strata. In the index, however, this resemblance

the greenstones. The post-Carboniferous earth-movements have produced conspicuous cleavage and cross-cleavage in the Devonian shales of Watergate Bay, whereby the original bedding is at times entirely lost. Plate iii. is here reproduced, as a particularly beautiful example of cleavage-planes with secondary puckering, and no trace of true stratification.

The Geological Survey of Ireland has issued a memoir on "The Geology of the Country around Limerick," by Mr. G. W. Lamplugh and the staff of the Survey, as constituted at the time of its transfer to the Department of Agriculture and Technical Instruction (Dublin, 1907, pp. vi+120, price 2s.). The drift edition of parts of Sheets 143 and 144, forming a special colour-printed map with Limerick nearly in the centre, is issued simultaneously, price 1s. 6d. The area is largely covered by Boulder-clay, but includes exposures of the interesting volcanic and intrusive rocks that are here associated with the Carboniferous Limestone. The seven photographic plates by Mr. H. J. Seymour illustrate all the important rocks of the district, and include a good example of beds of limestone carried bodily forward in Boulder-clay from the area surveyed by the author of the plate. Though the main object of the memoir was the description of the superficial deposits, a number of new observations on the underlying rocks have been added by Mr. Kilroe. The same writer has dealt with the economic geology, and particularly with the soils and subsoils.



Puckerred slate showing "strain-slip," north-end of Watergate Bay, Newquay, Cornwall.

is greater than in the actual map. In the memoir we touch the work of many previous writers, including De la Beche and Fitton, and have the advantage of the views of Mr. Jukes-Browne on the correlation of the Cretaceous series.

In the second memoir ("Explanation of Sheet 346. The Geology of the Country near Newquay," pp. iv+132, price 3s.), Messrs. Clement Reid and Scrivenor describe an area in which the interest ranges from the Pliocene outlier of Saint Agnes to partly abandoned tin and copper mines. The close relation between the lodes and the metamorphic aureole of intrusive granite is at once obvious on the map. The economic section and appendix, the latter by Mr. D. A. Macalister, justly occupy forty-eight pages of the memoir. The granite cuts rocks of Lower Devonian age, which are now coloured on the map in tints of grey. The old familiar brown colour appears in the area of beds, now known to contain Pteraspis, near St. Mawgan, above which undoubtedly marine strata prevail. Interesting veins containing axinite are described by Mr. Flett in association with certain intrusive greenstones. They are attributed to "pneumatolytic" action, such as promoted the formation of tourmaline in other places, and are thus connected with the intrusion of the granite. These garnet-axinite-augite-epidote veins are held to have occurred where lime-silicates or patches of impure carbonate of lime were provided by

THE COATS OBSERVATORY, PAISLEY.¹

THIS observatory, the establishment and maintenance of which are entirely due to the munificence and public spirit of the Coats family, is situated about seven miles to the westward of Glasgow. From a meteorological point of view it occupies a very important position, being in the path frequently taken by the storms coming from the Atlantic Ocean. The observatory is now fully equipped with ordinary and self-recording meteorological instruments; there was, however, at first no intention of carrying on meteorological work, but Mr. Thomas Coats before his death, in October, 1883, having provided a standard barometer and thermometer, the committee of management afterwards supplied other instruments, and with these observations were regularly taken morning and evening. The records are preserved by the Paisley Philosophical Institution; readings have been transmitted monthly to the Scottish Meteorological Society, and the results are also separately published by the institution. The observatory was originally established for astronomical purposes, and was placed under the care of the Philosophical Institution. Mr. Thomas Coats generously offered to relieve the society of all expense in the matter, and to provide a suitable building, and he expressed the hope that the establishment would "prove a stimulus to interest the rising generation of the town and neighbourhood in the study of astronomy—a science little understood among us, but which may, under the leading spirits of our Philosophical Institution, become a subject of instruction that will be eagerly sought after." He endowed the institution with the sum of 2000*l.* in trust, and the observatory was opened to the public on October 1, 1883. We are indebted to the Philosophical Institution for the accompanying illustration of the observatory.

The original design was enlarged by the founder, who supplied a transit instrument, clocks, &c., and after his death his representatives intimated their desire to render the equipment still more complete, and added another

¹ "The Coats Observatory, Paisley; its History and Equipment." By Rev. A. Henderson. Pp. 48. (Paisley: J. and E. Barake.)